W. WHITE.

REMOVING IMPURITIES FROM MOLTEN METAL.

APPLICATION FILED NOV. 1, 1918.

1,332,585.

Patented Mar. 2, 1920.

FIG.1.

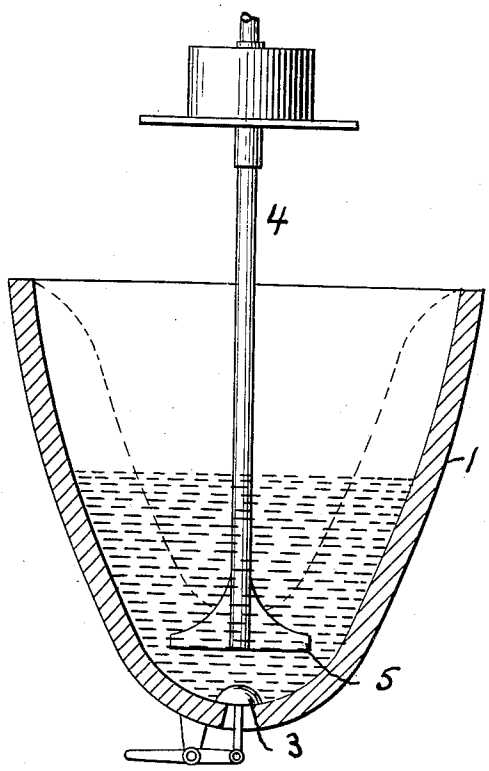
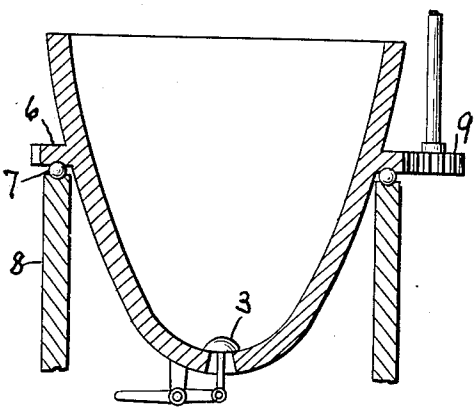


FIG.2.



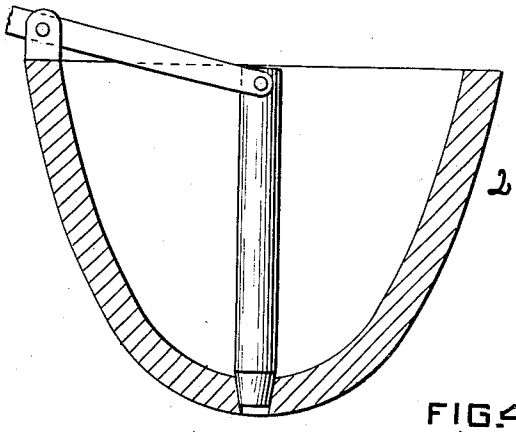


FIG.3.

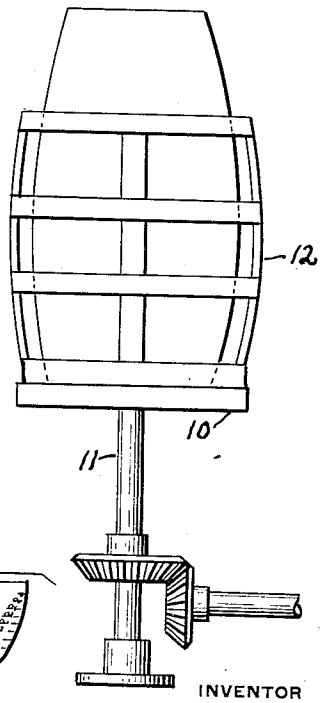
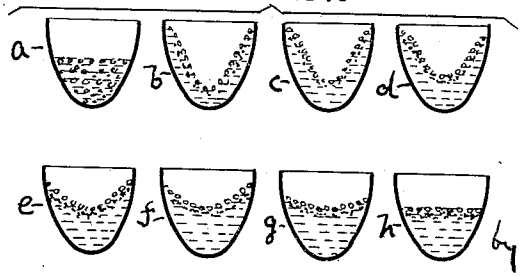


FIG.4.



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REMOVING IMPURITIES FROM MOLTEN METAL.

1,332,585. Specification of Letters Patent. Patented Mar. 2, 1920.

Application filed November 1, 1918. Serial No. 260,665.

To all whom it may concern:

Be it known that I, WILLIAM WHITE, residing at Washington, in the District of Columbia, a citizen of the United States, have invented or discovered certain new and useful Improvements in Removing Impurities from Molten Metal, of which improvement the following is a specification.

All of the modern processes that reduce oxids to the metallic state obtain their product in a liquid condition and speaking generally it may be stated that only with the greatest difficulty can the liquid product be separated from occluded gases and occluded oxids and a number of methods are used to free the bath of metal from these objectionable impurities, such as adding ferro manganese, ferro silicon, metallic aluminum, metallic magnesium, carbid of calcium, etc., etc., to the molten bath.

These methods are all good in their own way and without them the metal industry would be lost, but the method herein described is for the purpose of effectually removing from a bath of molten metal the impurities, gases, etc., which have become occluded or held mechanically within the mass or body of the metal, and which cannot be discovered in many cases until after considerable work and money has been expended in forming the desired article from the casting. It is proposed to obviate this difficulty as much as possible by applying the laws of hydro-mechanics to the solution of the problem. It should be stated that although the occluded gases, oxids, and other foreign materials are of less specific gravity than the molten metal, the difference is not great enough to cause the gases, etc., to move up through the dense molten metal. But by imparting such a rotary movement to the metal as to change the position of the surface of the metal from a horizontal to an approximately vertical position, the sound metal being more effectively acted on by centrifugal force, will move outwardly, squeezing out the gases and impurities and forcing them toward or to the vertically disposed surface which is then permitted to assume a horizontal position without any shifting of the position of the impurities relative to such surface.

In the accompanying drawings forming a part of this specification Figure 1 is a sectional elevation of a form of apparatus for treating metal in relatively large masses; Fig. 2 is a sectional elevation showing a modification of the apparatus; Fig. 3 is a similar view of an apparatus for treating the metal while in the crucible in which it was melted, and Fig. 4 shows diagrammatic illustrations of the results produced in the practice of the invention.

The invention described herein has for its object the separation of gases and other impurities from the molten metal by imparting to the metal while in a fluid condition, such a rotary movement as will subject all portions of the mass to a centrifugal force and then separate the occluded gases and other materials from the sound metal, before the latter is subjected to any fabrication. The invention is hereinafter more fully described and claimed.

When treating metal which has been melted, in an open hearth or other furnace, and in which occluded gases, oxids, and other impurities are disseminated, as indicated in diagram *a*, the metal is run from the furnace into a vessel 1 and caused to rotate at a sufficiently high speed that the metal will move up along the inner surface and distribute itself with such substantial uniformity in depth as is possible over the inner surface of the vessel and changing the position of the surface of the metal from horizontal to vertical and at right angles to the centrifugal force as shown in diagram *b*. As the gases and other impurities are much lighter than the metal the latter will move more rapidly outward than the gases, etc., and being rendered more dense, will squeeze out the gases, etc., and crowd them toward and to the vertical surface due to the vortex formed in the center of the mass of metal. After the metal has been subjected to the centrifugal action for a sufficient time, the rotary movement is reduced so that the metal along the sides will slowly move down and rise at the center of the vortex until it fills the concavity and equilibrium is established, as shown in diagrams *c* to *h*. During the centrifugal action, the impurities and gases will be, as before stated, crowded to the surface of the metal and by reducing the speed of rotation, the relative positions of the impurities and sound metal will not be changed and the former will be found at or closely adjacent to the surface of the mass when it has returned to its normal horizontal position. The sound metal can then be drawn off into a ladle or other vessel 2 by

opening the valve 3 in the bottom of vessel 1 or the impurities can be skimmed off.

Any suitable means may be employed for imparting the desired movement to the metal. As for example, in the form of apparatus shown in Fig. 1 a vertical shaft 4 adapted to be rotated by any suitable means which extends down into the metal and the portion submerged in the metal is provided with radially projecting blades 5. In the construction shown in Fig. 2 the vessel is so supported as to be capable of being rotated. A convenient construction for this purpose consists in forming a flange 6 on the vessel, said flange bearing on balls 7 arranged in a raceway in the upper end of the annular base 8. The vessel is rotated by a driven pinion 9 intermeshing with teeth on the periphery of the flange.

In Fig. 3 is shown an apparatus suitable for rotating crucibles and consists of a platform 10 on the upper end of a rotatable shaft 11, the platform being provided with a retaining frame 12. It will be understood that when the metal is treated in crucibles, the impurities will be removed by skimming before the good metal is passed into the molds.

I claim herein as my invention:

1. The method of eliminating gases and other impurities from molten metal which consists in imparting a rotary movement to the metal to shift the surface of the metal from a horizontal toward a vertical position and forcing the good metal toward the exterior of the mass of molten metal and then slowly reducing the rotary movement to permit of the restoration of the surface from a vertical to a horizontal position and separating the portions of the charge containing the impurities from the sound metal.

2. The method herein described of eliminating gases and impurities from molten metal which consists in imparting a rotary movement to the metal gradually reducing the rate of rotation and separating the portions of the purified metal from the portions of the charge into which the impurities have been forced.

In testimony whereof, I have hereunto set my hand.

WILLIAM WHITE.